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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/071,809	02/07/2002	Tinghao F. Wang	10200-16	9444

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EXAMINER

DEO, DU Y VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 05/16/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

53

Office Action Summary	Application No.	Applicant(s)	
	10/071,809	WANG, TINGHAO F.	
	Examiner	Art Unit	
	DuyVu n Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 3-12, 14, 15, 21-23, 25 and 27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 3-12, 14, 15, 21-23, 25, 27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 12 is rejected under 35 U.S.C. 102(b) as being anticipated by Bourassa et al. (Us 4,414,057).

Bourassa teaches a method of etching a metal silicon layer in an environment having a concentration of O₂ can be added at about 5 SCCM to increase the etchrate. This concentration would be greater than 25% by V when the Freon gas being used is at 10 SCCM during the metal silicide etch (col. 3, line 22; col. 4, line 6). Since the concentration of O₂ is the same as that of the claim, greater than 25%, the metal silicide would be etched with respect to an underlying polysilicon layer with a ratio of etch rates of at least 30. The gas pressure is maintained at 10 mTorr (col. 4, line 45). This would read on claimed etching is carried out at a pressure of 2-40 mTorr.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 3-12, 14, 15, 21, 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai (US 5,880,033).

Tsai describes a method of etching metal silicide (WSi) using Cl₂ and O₂. The pressure is ranging from 2-20 mTorr, 4 mTorr is used in the example. The first power is about 200-2000 watts, and second power (bias power) is about 5-500 watts. The Cl₂ flow rate is about 20-800 sccm, and O₂ flow rate is about 1-50 sccm (summary; col. 4, line 14-15; col. 5, line 1-25; col. 7, line 10-25, line 50-col. 8.) Unlike claimed invention, Tsai doesn't describe the claimed O₂ concentration of 25 % V or greater, such as 25-30% V. However, he shows a O₂ high flow rate or concentration (concentration of etchant would be proportional to the flow rate), are desirable, an increase in O₂ flow rate from 0 to 10 sccm increases the WSi etch rates from 250 nm/min to 350 nm/min; he also teaches the power ratio of the first power to the second power is selected to enhance the ability of the etchant plasma to anisotropically etch the metal silicide layer and the flow rates are dependent upon the size of the process chamber. Therefore, it would have been obvious for one skill in the art through routine experimentation to determine the optimum parameters such as flow rates power level in order to etch WSi with high etch rate and high selectivity to the under polysilicon layer, such as 30 or more, with an anticipation of an expected result.

Concerning to claims 10 and 11, the time to completely etch WSi would have been obviously depending on other factors such as WSi thickness and parameters. A 30 seconds time period would be achievable since Tsai's parameters are overlap claimed parameters.

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5. Claims 1, 3-12, 14, 15, 21, 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tabara et al. (US 6,150,250) and Tsai (US 5,880,033).

Tabara describes a method for etching WSi in a Cl₂/O₂ environment having flow rate of 25 sccm for Cl₂ and 11 sccm for O₂, which would provide an O₂ concentration of higher than 25% by volume (col. 7, line 5-15), or O₂ is from 0-13 sccm. Even though he is silent about the ratio etch rate, of the WSi to the poly, of at least 30; however since the etching gas includes the same gas and the same concentration of O₂ as that of the claims, his method would provide claimed the ratio etch rate, of the WSi to the poly, of at least 30. The source power is 1400W and the radio frequency power (bias power) is 40W (col. 7, line 12-13).

Unlike claimed invention, Tabara doesn't describe the claimed parameters such as 2-40 mtorr such as 3mtorr P, source power at 400W, 25-30% volume O₂, 45 sccm Cl₂, 30 sccm O₂, and a 30-seconds of etching. Tsai describes a method of etching metal silicide (WSi) using Cl₂ and O₂. The pressure is ranging from 2-20 mTorr, 4 mTorr is used in the example. The first power is about 200-2000 watts, and second power (bias power) is about 5-500 watts. The Cl₂ flow rate is about 20-800 sccm, and O₂ flow rate is about 1-50 sccm (summery; col. 4, line 14-15; col. 5, line 1-25; col. 7, line 10-25, line 50-col. 8). These processing parameters include claim parameters. Therefore, it would have been obvious for one skill in the art through routine experimentation to determine the optimum parameters such as flow rates power level in order to etch WSi with high etch rate and high selectively to the under polysilicon layer, with an anticipation of an expected result.

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6. Claims 22, 23, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai or Tabara as applied to claims 1 and 21 above, and further in view of Langley et al. (Semiconductor International, October 1989).

Unlike claims 22, 23, and 25, above prior art doesn't describe a breakthrough etch using gas comprising CF₄. Langley teaches method of etching silicide/poly wherein he teaches etching a native oxide on the silicide using a gas comprising CF₄ (pg. 97, 1st col., 2nd paragraph) before etching the silicide. This would reads on claimed breakthrough etch. It would have been obvious at the time of the invention for one skill in the art to modify Tsai or Tabara in light of Langley in order to remove a native oxide on the silicide before etching of the silicide.

Response to Arguments

7. Applicant's arguments filed 3/24/03 have been fully considered but they are not persuasive.

Applicant's argument about Tsai shows an O₂ concentration of 15% in the example and Tsai doesn't describe the selectivity is acknowledged. However, the O₂ and Cl₂ ranges described by Tsai would includes claimed O₂ concentration of greater than 25 %V. The fact that there is a range for each processing parameter shows that these processing parameters are result-effective variable and must be determined through routine experimentation. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Further more, since it is well known to any skill in the art that the etchants are tailored to etch a material with selectivity comparing to other under or upper material. Otherwise, a structure cannot be formed if everything is etched or removed during a fabrication of a semiconductor structure. Also, the background of the specification describes that it is desired and known to one skill in the art to etched silicide selectively to the

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poly. Since the ranges described by the prior art would include claimed ranges and it is desired to etch any material such as silicide selectively comparing to other materials. Choosing optimum processing parameters through routine experimentation would be obvious to one skill in the art.

Applicant's analysis of figure 20 of Tabara showing the poly is always etched faster than WSi₂ is vague and unclear. It is unclear how the upper left curve (Si/TiN ratio curve) and the bottom curve (TiN at 0% O₂) would show the poly is always etched faster than WSi₂.


Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD
May 14, 2003


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